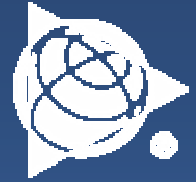
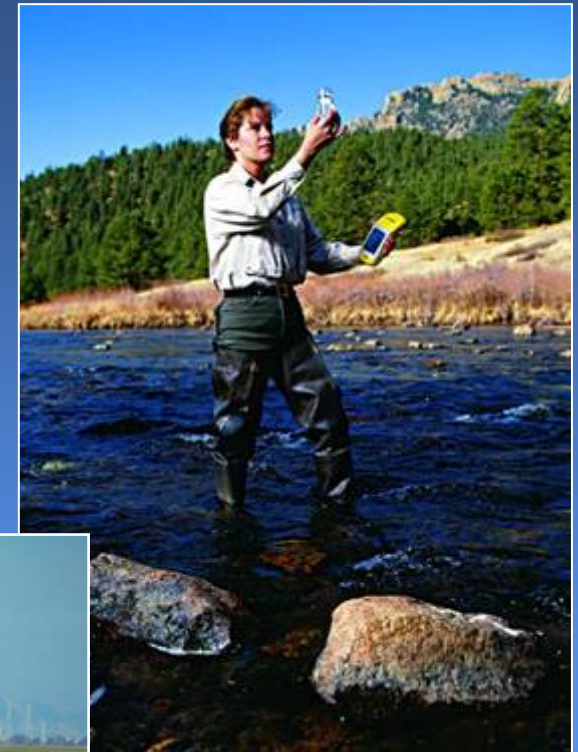


Field Data Collection

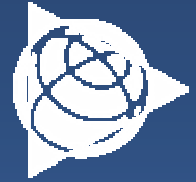


*Jim Grummon
Allen Instruments*



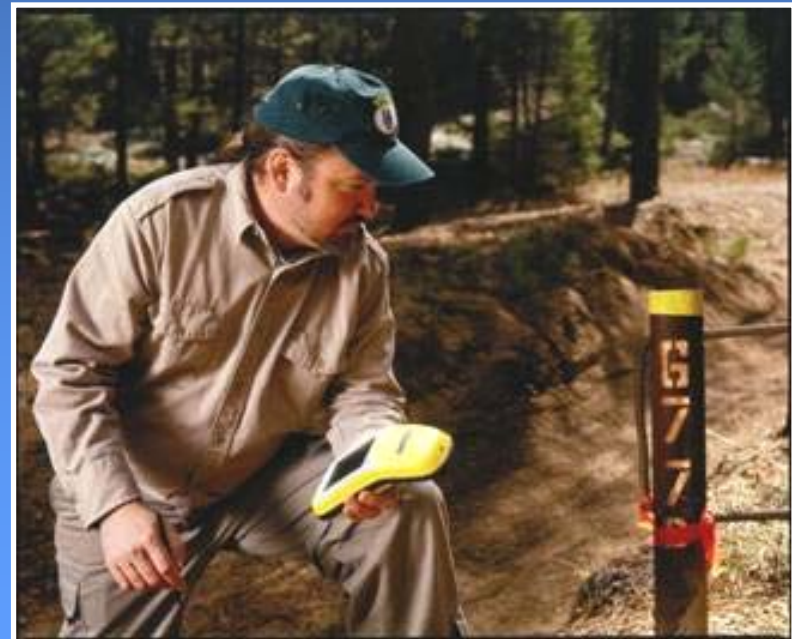
*January 13, 2004
San Ramon, CA*

GIS Going Mobile

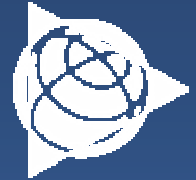


Mobile GIS involves GIS-enabling an organization's field workforce where they work.

- ◆ Portable
- ◆ Rugged
- ◆ Outdoor viewable
- ◆ Connected
- ◆ Standard



GeoExplorer CE Series



GPS-enabled mobile GIS.

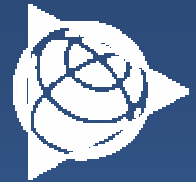
- ◆ Flexible and Versatile
- ◆ Reliable and Secure
- ◆ Integrated and Open



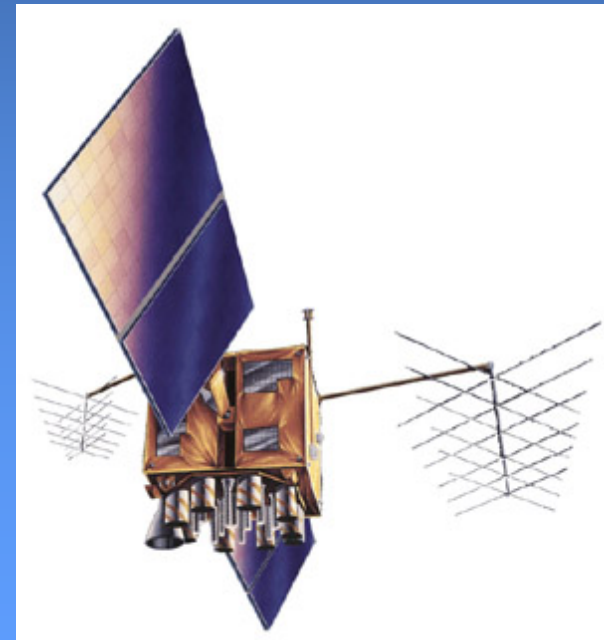
* 4 GeoXTs
*Available for
April Drill*



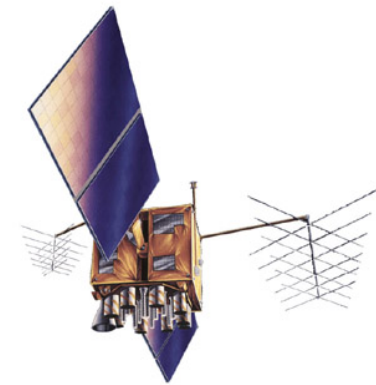
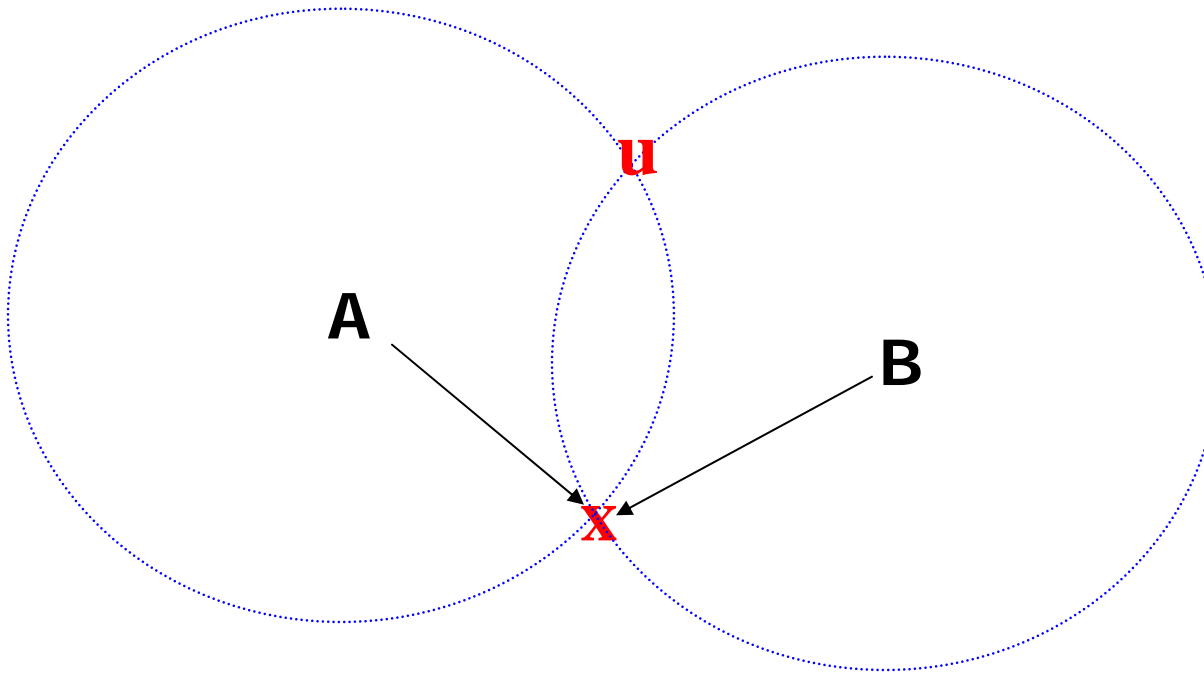
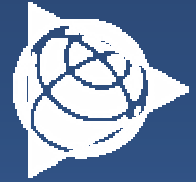
Global Positioning System (GPS) How It Works



- **24 Satellites - Full Constellation**
- **Currently 28 active**



GPS: Finding Distance by Measuring Time

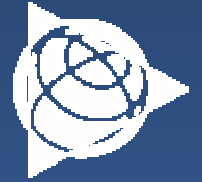
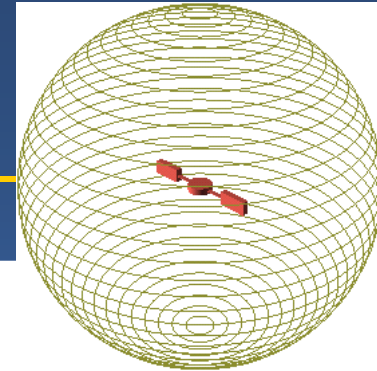


GPS Satellite

4:00 p.m. >> << 7/100 of a second after 4:00 p.m.

Clocks synchronized { **Receiver:** G J K E T Y U O W V W T D H K ...
Satellite: G J K E T Y U O W ...

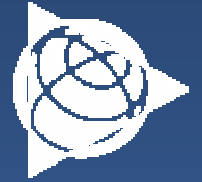
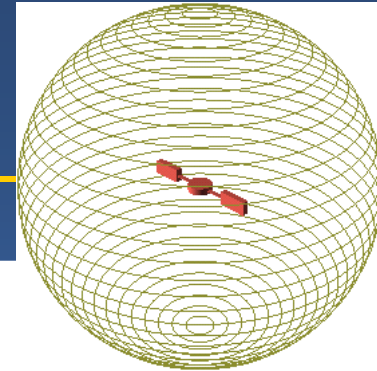
Satellite Location



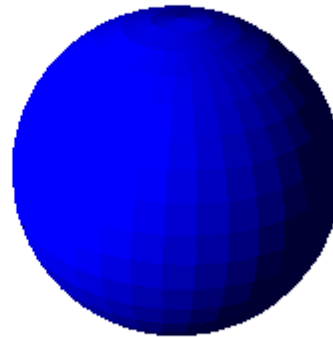
◆ Given 1 satellite ...

•

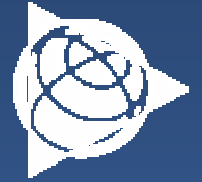
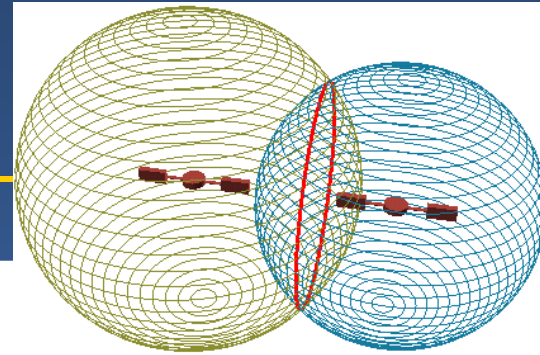
Satellite Location



- ◆ We can locate our position on the surface of a sphere



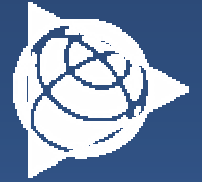
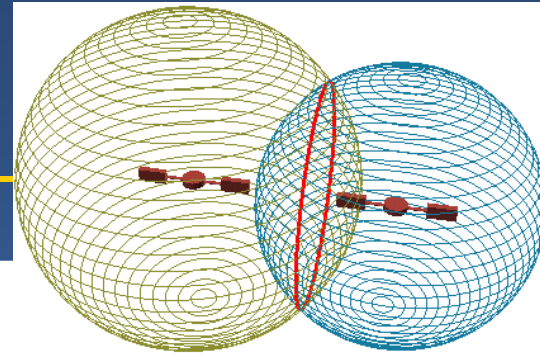
Satellite Location



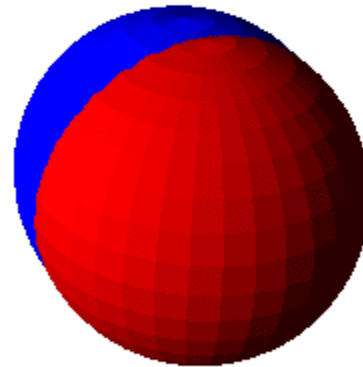
◆ Given 2 satellites ...



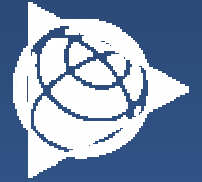
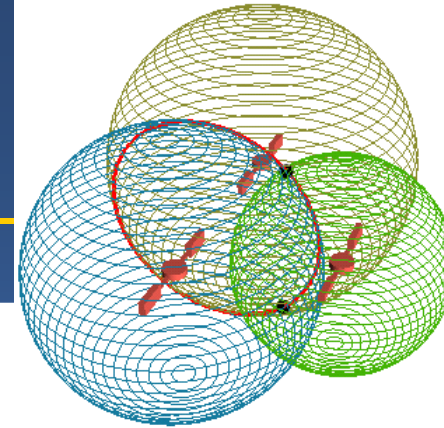
Satellite Location



- ◆ We can locate our position on the intersection of 2 spheres (a circle)



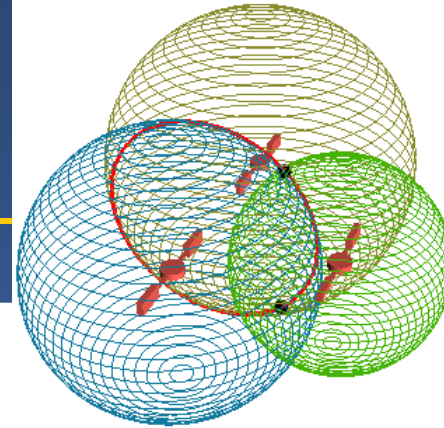
Satellite Location



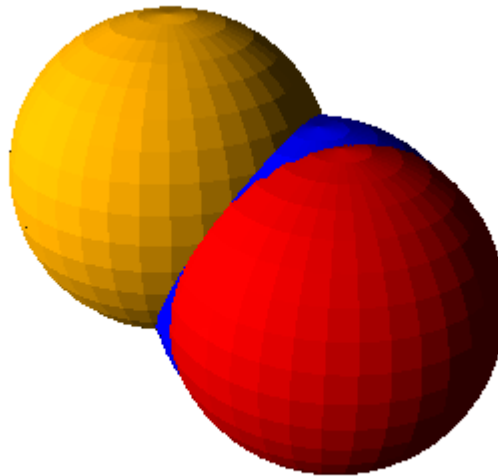
◆ Given 3 satellites ...



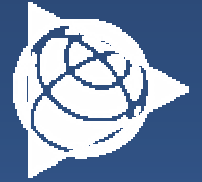
Satellite Location



- ◆ We can locate our position on the intersection of 3 spheres (2 points)



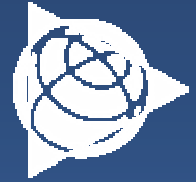
Satellite Location



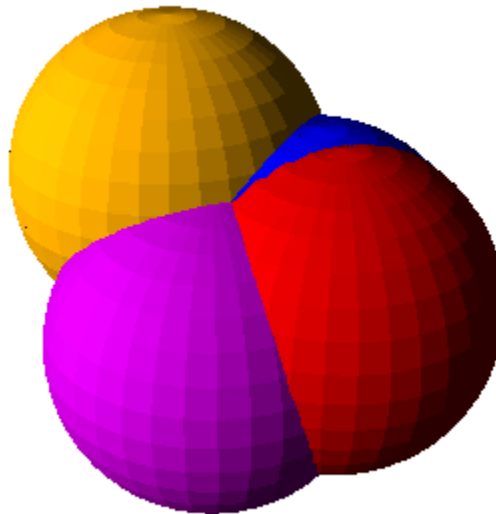
◆ Given 4 satellites ...



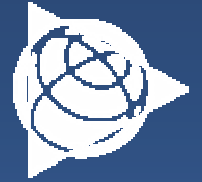
Satellite Location



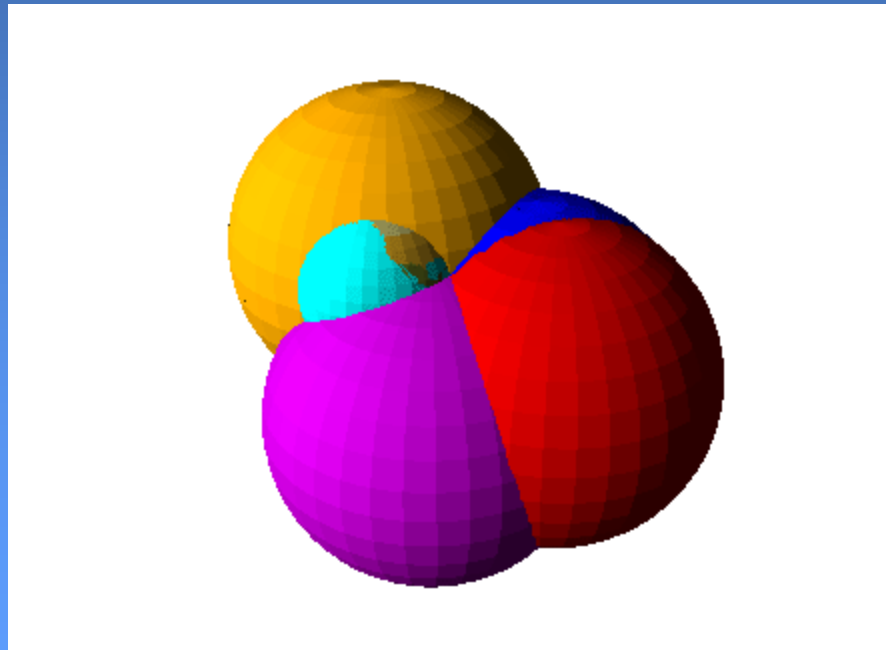
- ◆ We can locate our position on the intersection of 4 spheres (1 pt)



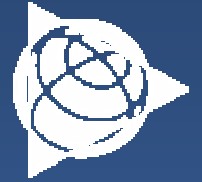
Satellite Location



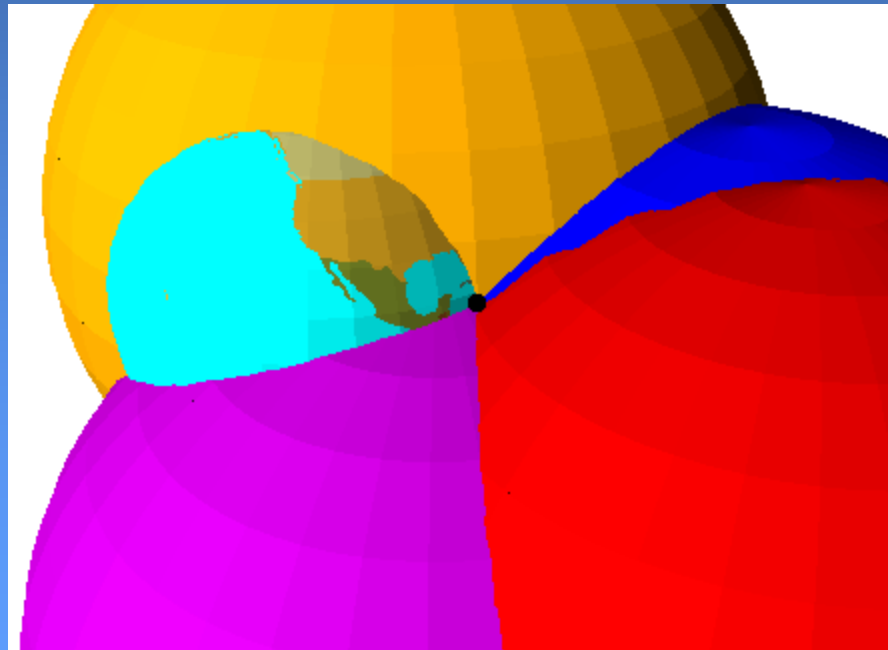
- ◆ The point can be located on the earth's surface



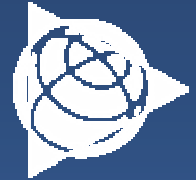
Satellite Location



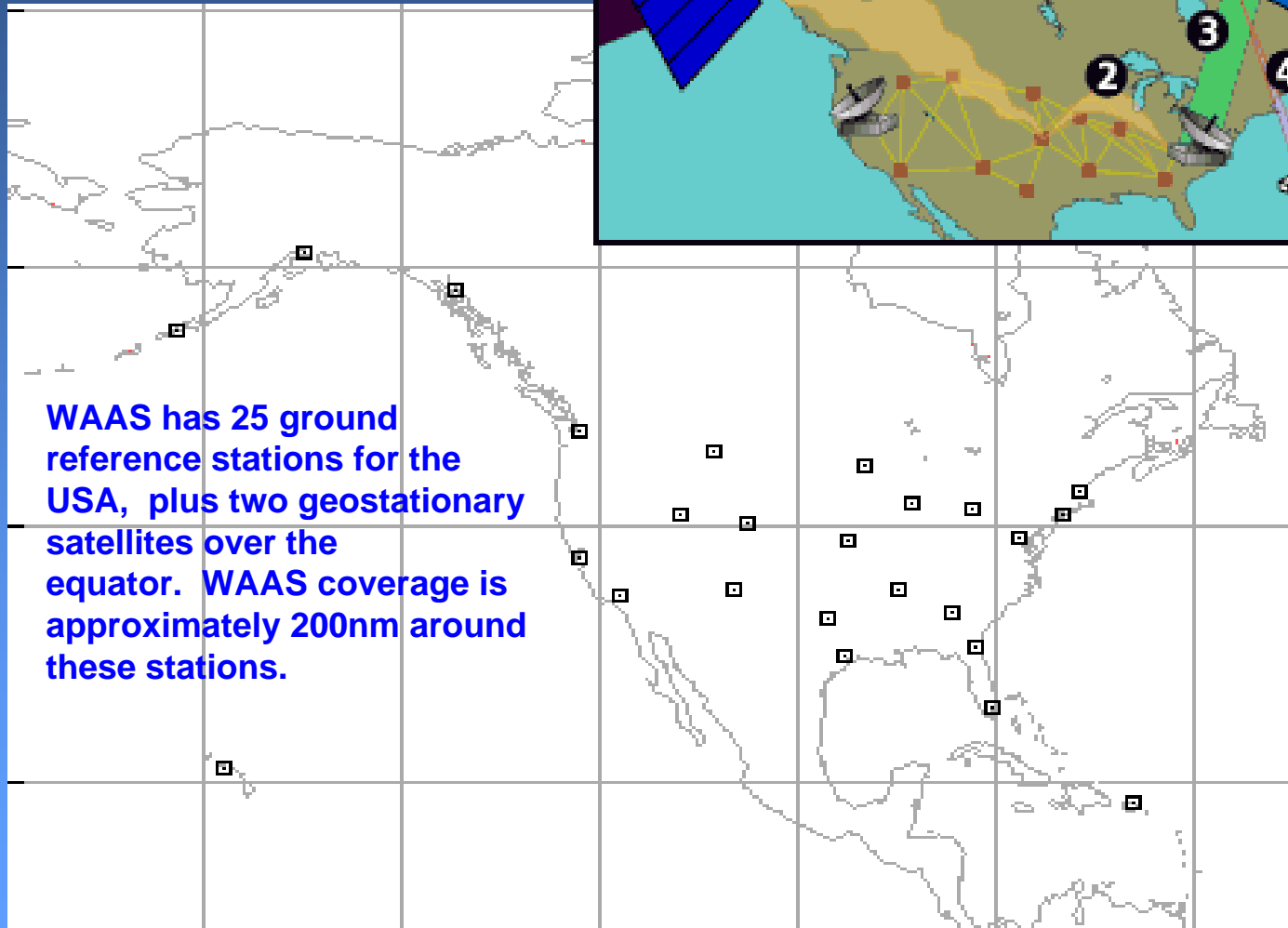
- ◆ The precise position is determined



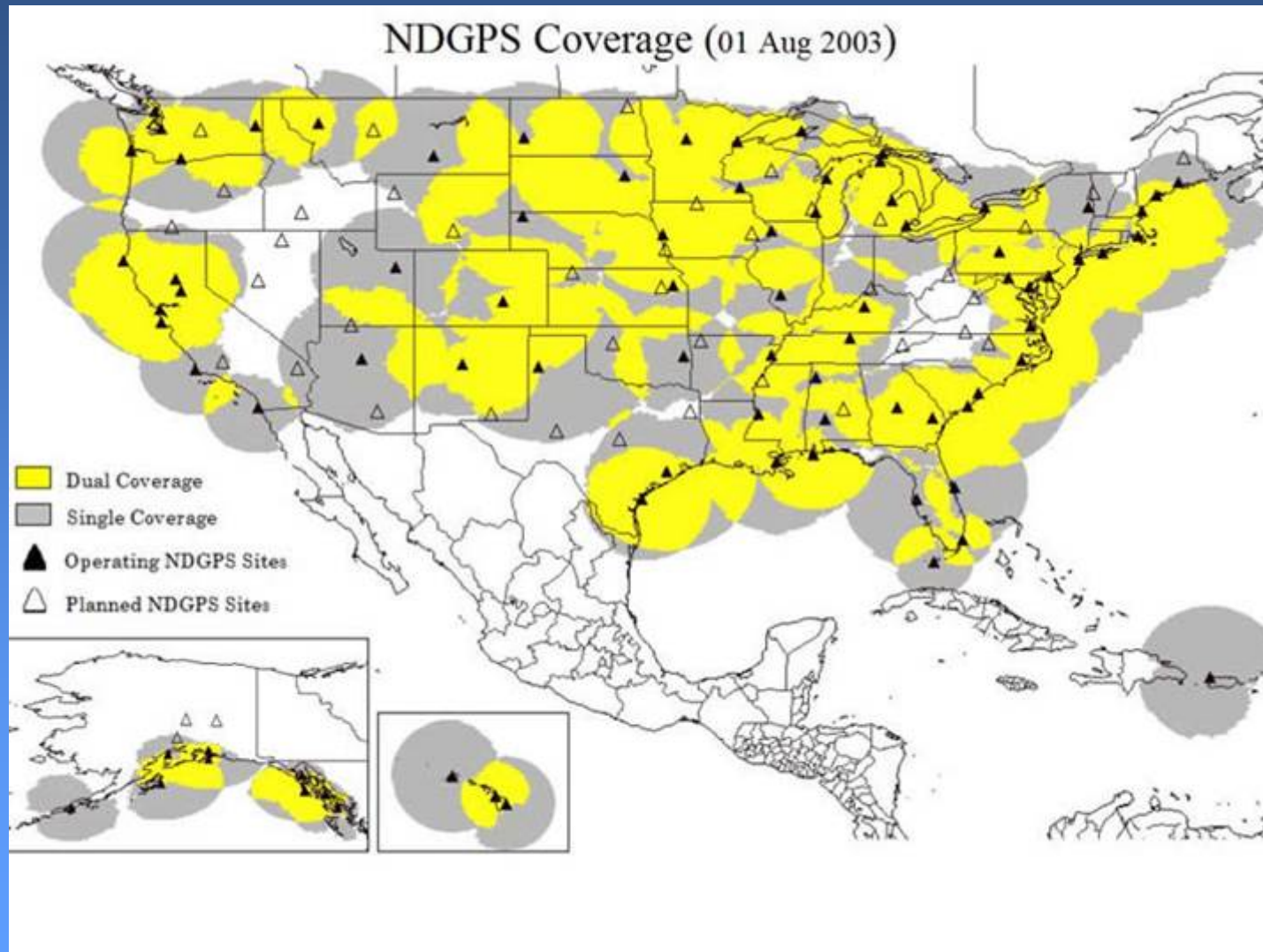
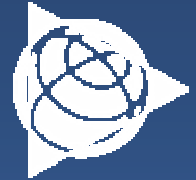
WAAS



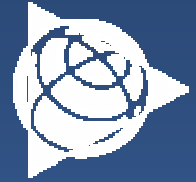
WAAS has 25 ground reference stations for the USA, plus two geostationary satellites over the equator. WAAS coverage is approximately 200nm around these stations.



BEACON



GPS Hardware Choices



Autonomous GPS



10m

GeoXM GeoXT XRS



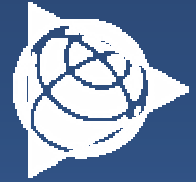
5m

2m

1m

.5m

Field Applications



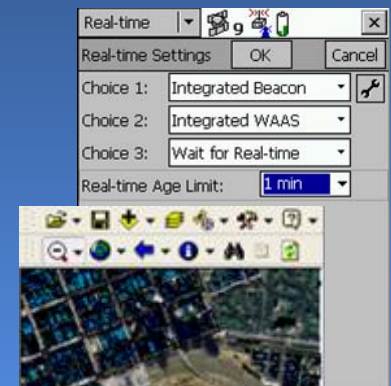
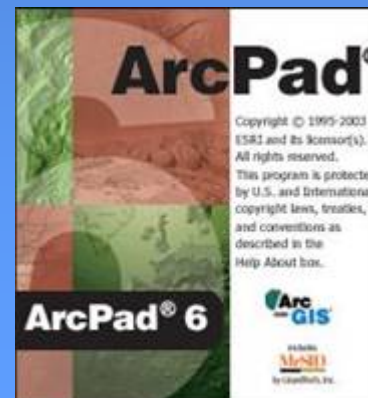
➤ TerraSync

- ◆ Sophisticated data collection & maintenance
- ◆ GIS & CAD File Upload



➤ ArcPad

- ◆ Bringing full GPS control to ESRI's GIS software
- ◆ GeoDatabase Connectivity



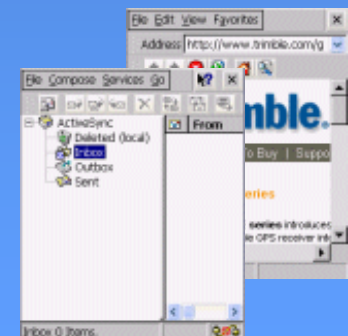
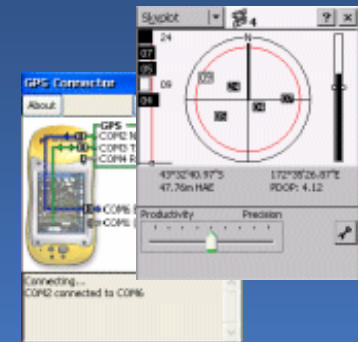
GPS Controller

- ◆ Integrated GPS control
- ◆ In-field mission planning

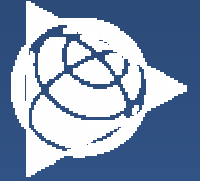
GPS Connector

- ◆ Establish connections with external data loggers

➤ Windows CE productivity tools



Reliable and Secure

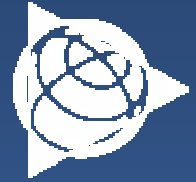


Works where and when you need it.

- ◆ Rugged
- ◆ Outdoor viewable color
- ◆ All day battery
- ◆ Safe Flash-based storage



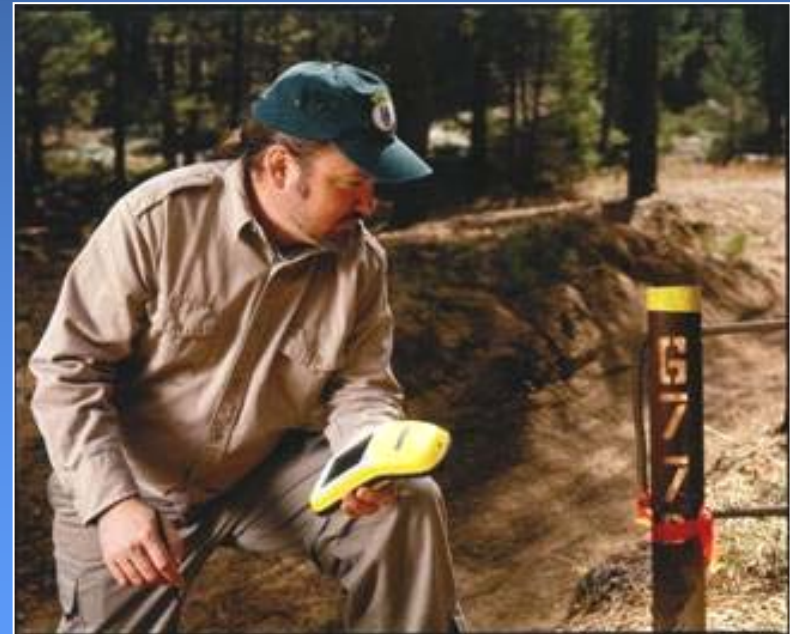
Secure Storage



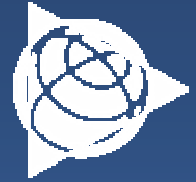
Flash Disk:

Applications and data
in non-volatile Secure

Main Memory (RAM):
Running programs and
system files



GeoExplorer CE Series Handheld



➤ Integrated GPS

- ◆ Fully integrated GPS receiver and antenna
- ◆ WAAS DGPS
- ◆ EVEREST multi-path rejection (tree canopy)
- ◆ No Cables

➤ Windows CE .NET operating system

- ◆ Connection to the enterprise
- ◆ Abundance of applications
- ◆ Standard and familiar

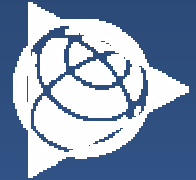
➤ Large storage capacity for GIS data

➤ All-day battery

➤ Rugged, waterproof design



Integrated and Open

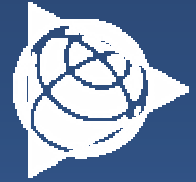


➤ Integrated Bluetooth wireless technology

- ◆ Industry standard
- ◆ Short range wireless connections
- ◆ Integrated Bluetooth radio and antenna
- ◆ Bluetooth Manager software
- ◆ Connect to cell phones, handheld devices, PC's and peripheral devices



GPS Pathfinder Pro XRS



➤ Choice of GPS

- ◆ Beacon
- ◆ Satellite Differential (OmniStar/LandStar)
- ◆ WAAS
- ◆ Sub-meter

➤ Choice of Dataloggers

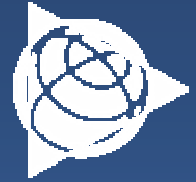
- ◆ TSCe
- ◆ Recon

➤ Choice of Dataloggers

- ◆ TerraSync
- ◆ ArcPad



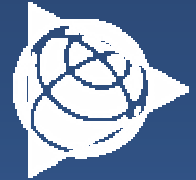
GIS TSCe Field Device



- ◆ Supports Trimble GPS Pathfinder receivers
- ◆ Windows CE .NET operating system
- ◆ Large storage capacity for GIS data
- ◆ All-day battery
- ◆ Rugged, waterproof design
- ◆ Full keyboard



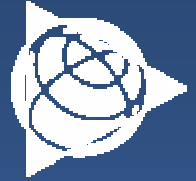
Trimble Recon Handheld



- ◆ Supports Trimble GPS Pathfinder receivers
- ◆ Windows Mobile 2003 for Pocket PC software
- ◆ Large storage capacity for GIS data
- ◆ All-day battery
- ◆ Rugged, waterproof design



Pro XRS Applications

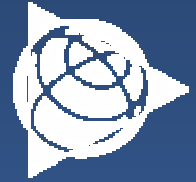


➤ Environmental studies

- ◆ Pollution control
- ◆ Water quality
- ◆ Species inventory
- ◆ Timber stands
- ◆ Wetlands delineation



TerraSync Data Collection

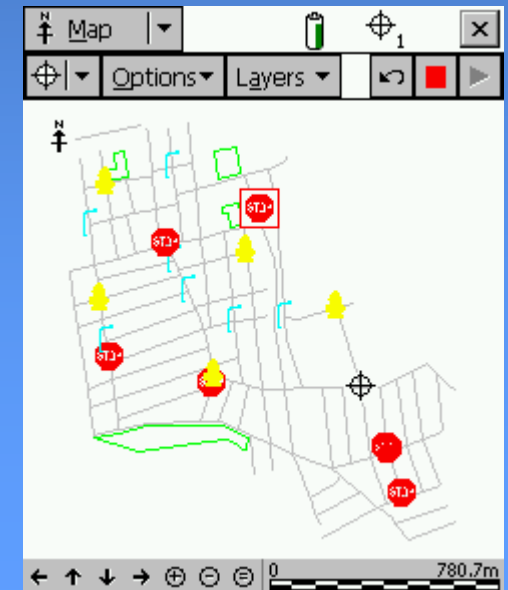


➤ Feature types

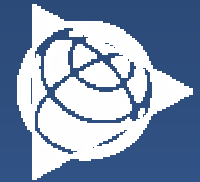
- ◆ Point, line and area features
- ◆ Excellent symbology

➤ Attribute types

- ◆ Comprehensive range, including menu, text, file and numeric types



Data Maintenance



- Update both feature geometry and attributes in the field
 - ◆ Including field entry rules
- Features flagged as updated for efficient export back into GIS or database

File: Sample Feature stored [X]

Update Options Close

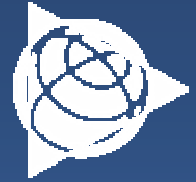
File: Sample [Begin]

Choose Feature:

#	Name	<input type="checkbox"/>	Distance
117	~Road	<input type="radio"/>	?
118	~Road	<input type="radio"/>	?
119	~Road	<input type="radio"/>	?
120	~Road	<input type="radio"/>	?
121	~Road	<input checked="" type="radio"/>	?
122	~Road	<input type="radio"/>	?
123	~Road	<input type="radio"/>	?
124	~Road	<input type="radio"/>	?
125	~Road	<input type="radio"/>	?
126	~Road	<input type="radio"/>	?

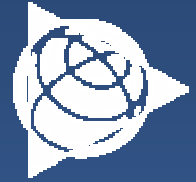
Positions: 2
Length(2D): 21.47 m (3D) 21.47 m
Name: Division St
Number of Lanes: 4

File Attributes

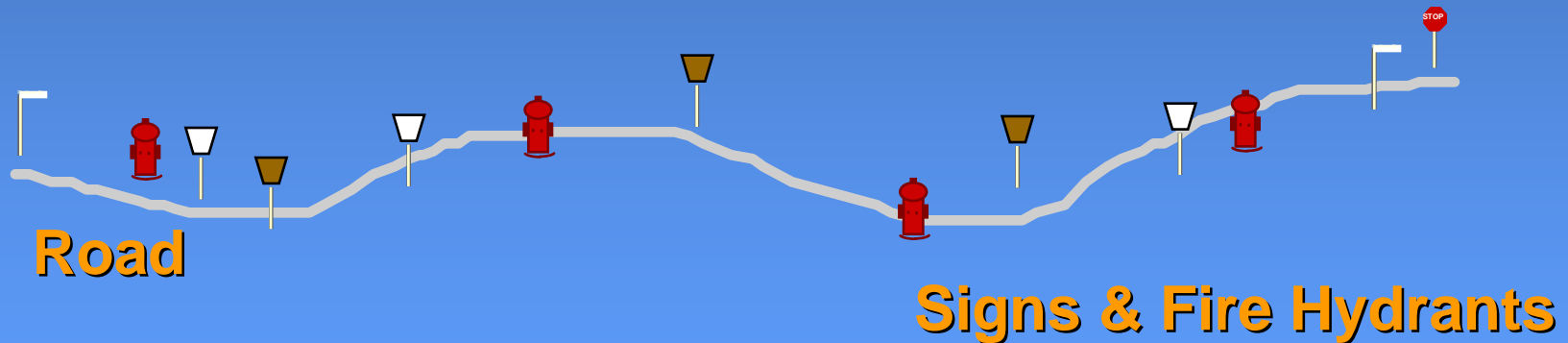


- **Attach files as attributes of a feature**
 - ◆ Digital image - a picture of the feature
 - ◆ Sound recording - a verbal description of the feature
 - ◆ Sketched diagram - historical records
- **Files attached in the field automatically stored and transferred with the data file**

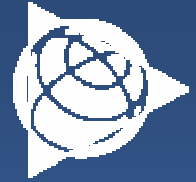
Continuing Features



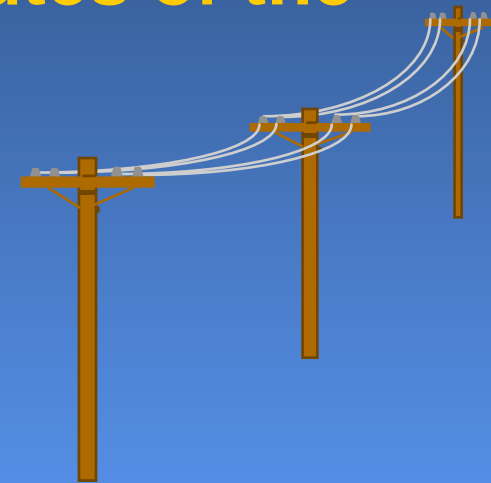
- Collect points, or other lines and areas, while recording lines and areas
- No need to retrace steps
- Improves field collection efficiency



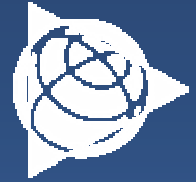
Repeating Features



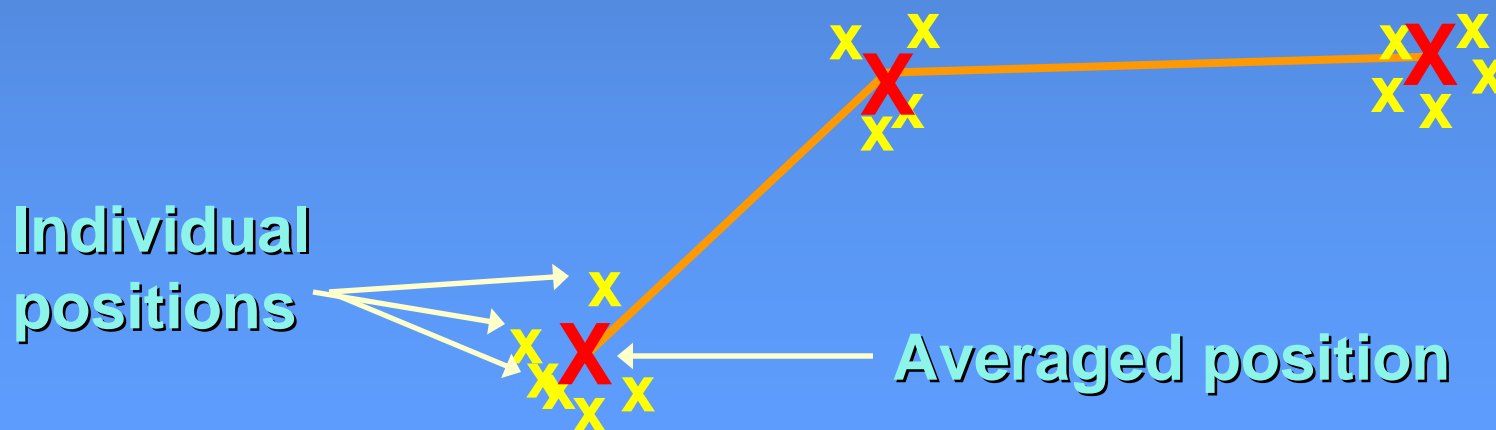
- Save time by repeating the attributes of the previous feature
- Useful when recording many similar features
 - ◆ Power poles
 - ◆ Flora/Fauna
- Auto-increment ID field to ensure unique identifier for each feature



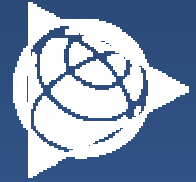
Averaged Points and Vertices



- Record accurate points and vertices
- Allows averaging of positions to form a single point or vertex within a line or area feature
- Vertices are ideal for recording corners of a building or field



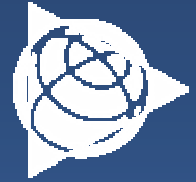
Offsets



- **Ideal for difficult to access locations or areas of poor GPS signal reception**
- **For Point features, defined by:**
 - ◆ Distance, bearing and inclination
 - ◆ Multi-distance
 - ◆ Multi-bearing
- **For Line and Area features, defined by:**
 - ◆ Distance and direction
- **Input manually or by using a laser rangefinder**



Laser Rangefinders



LaserAce



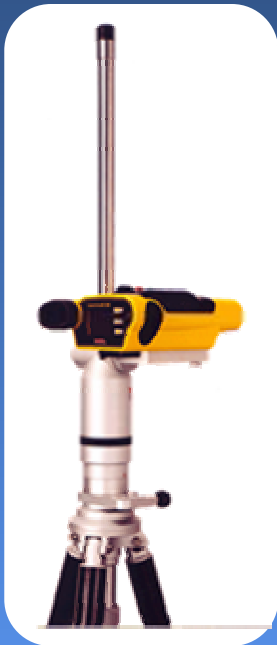
- Reflectorless
- Compass or Angle Encoder

- Object Heights
- Range, Bearing, & Inclination



ForestAce

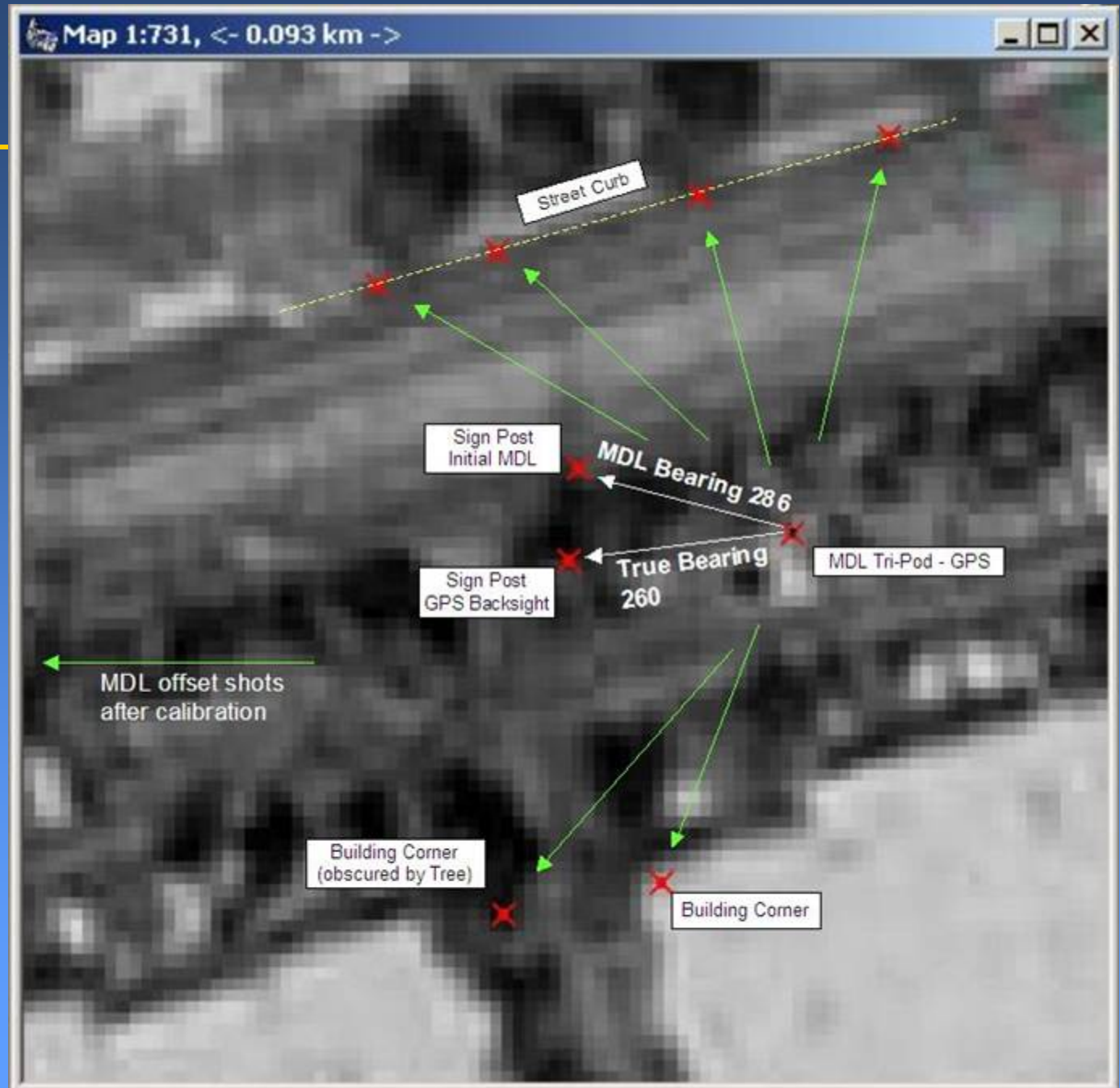
Laser Results



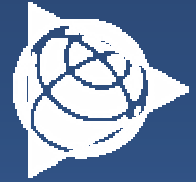
➤ Reflectorless
to 300M

➤ .1 Degree
Angles

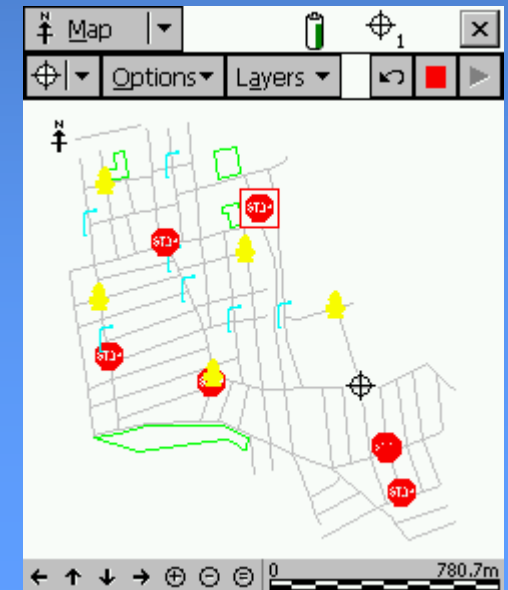
Allen Instruments



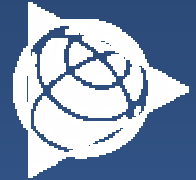
Digitizing



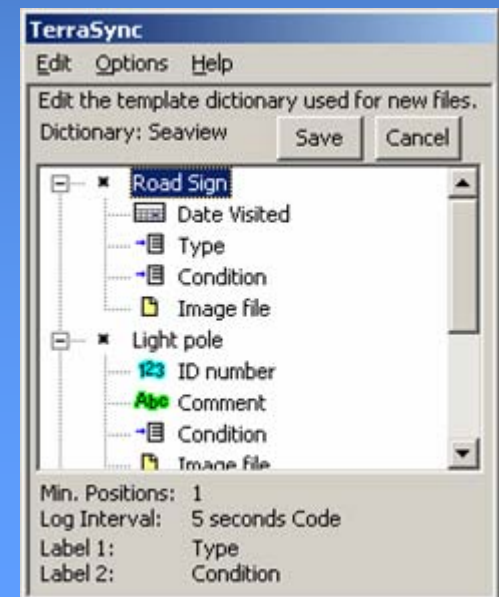
- Collect features when GPS signal reception is poor
- Click on the map to create a position or key in coordinates manually
- Ideal for use with background imagery and traversing



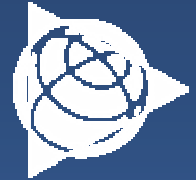
Data Dictionaries



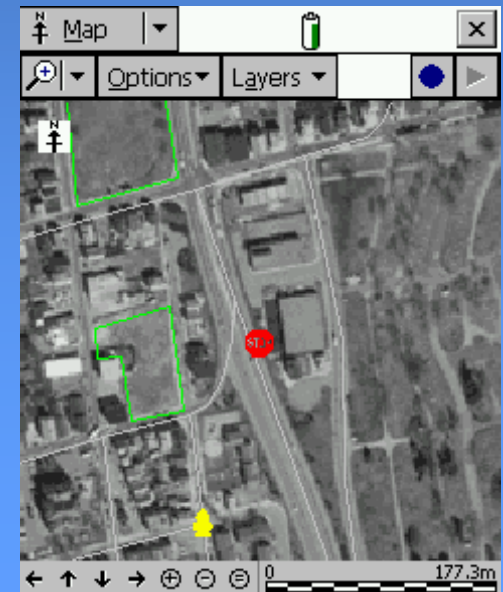
- Define the data to be collected in the field before you leave the office
- Easily add new items to the data dictionary in the field



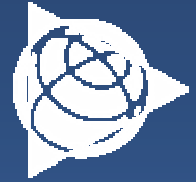
Background Maps



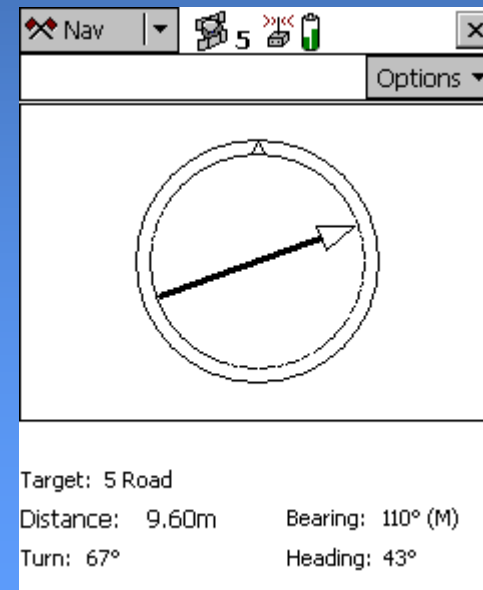
- **Use raster background maps in the field**
 - ◆ MrSid, BMP and JPEG images
- **Download and display data directly from an Internet Map Server**
 - ◆ ArcIMS
 - ◆ Microsoft TerraServer



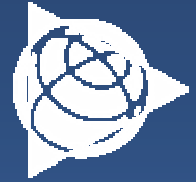
Navigation



- **Using GPS to find existing features**
 - ◆ For physical maintenance and repair
 - ◆ For attribute and position verification or update



Status & DGPS Displays

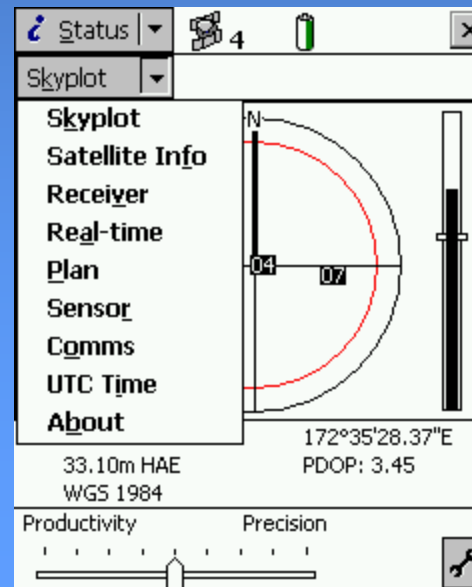


➤ Range of comprehensive GPS status display screens:

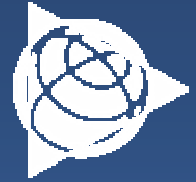
- ◆ GPS satellite information
- ◆ DGPS status
- ◆ Receiver status

➤ DGPS settings:

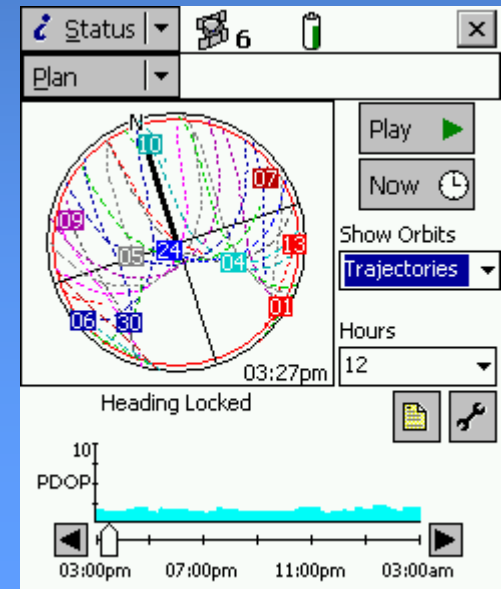
- ◆ Beacon
- ◆ Satellite
- ◆ WAAS



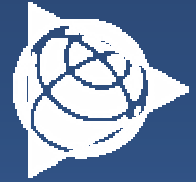
In-field mission planning



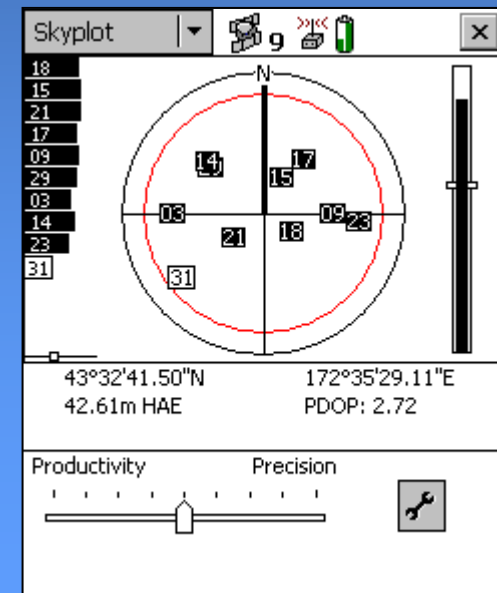
- **Planning skyplot**
 - ◆ View future satellite constellation, including trajectories and trails
- **Use time in the field more efficiently**
- **Increase productivity**



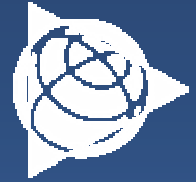
ArcPad GPS Integration



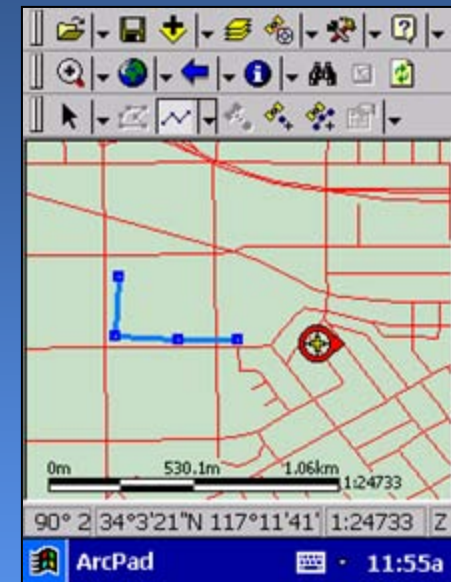
- ArcPad supports all Trimble Mapping & GIS GPS receivers
- Use the GPSCorrect extension for even tighter GPS integration
 - ◆ Status and setup of GPS Pathfinder or GeoExplorer CE series receiver
 - ◆ Real-time or postprocessed differential correction
 - ◆ Mission planning in the field



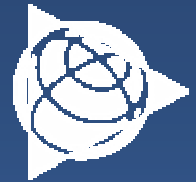
ArcPad Features: Data Collection



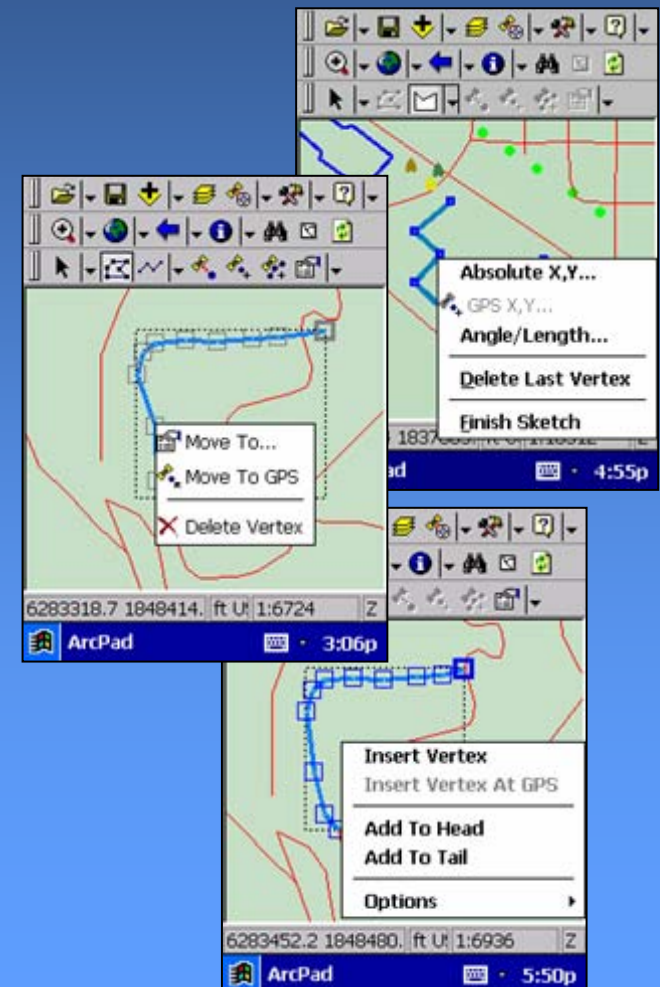
- Input positions from GPS or pen
- Data collection
 - ◆ Point, line, polygon
 - ◆ Attributes
 - ◆ Feature geometry
 - ◆ Existing or new features



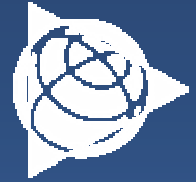
ArcPad Features: Advanced Geometry Editing



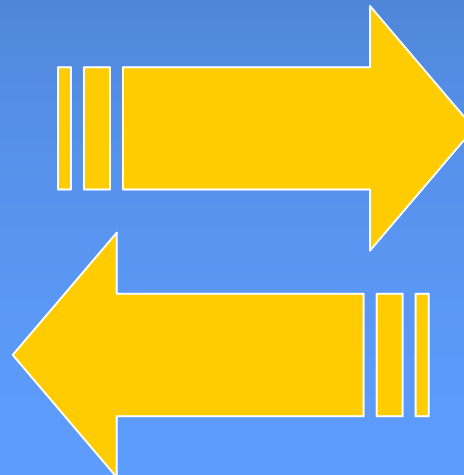
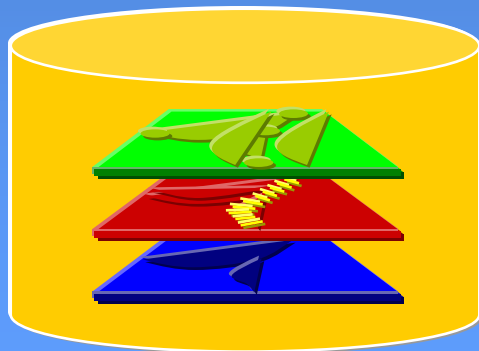
- Modify selected feature's geometry without collecting new position data
- Move features
- Edit vertices for lines and polygons
 - ◆ Insert, move or delete
- Measure distances, areas, and bearings
- Display vector and raster background layers



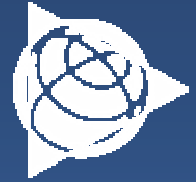
Smart ArcGIS Workflow



- Check data out of enterprise GIS geodatabase
- Use Check Out wizard to automatically create custom forms for attribute data entry
- Seamless download to ArcPad
- Check updated data back in to geodatabase
- ArcPad changes are automatically merged back into geodatabase



ArcPad Applications

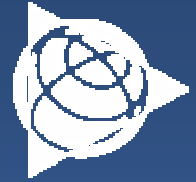


➤ Wide range of field tasks

- ◆ Inventory
- ◆ Monitoring
- ◆ Surveys
- ◆ Inspections
- ◆ Reporting
- ◆ Data validation



More ArcPad Applications

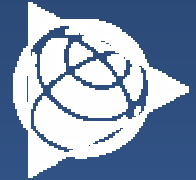


➤ Utility and urban asset databases

- ◆ Utility poles
- ◆ Road centerlines
- ◆ Transportation infrastructure
- ◆ Urban infrastructure
- ◆ Parcel inventory



Three Store Locations



With on-site instrument and supply showrooms, service centers, rental inventories, and training facilities in all locations.

Our Anaheim Store

